PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY
(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION See Form PCT/IPEA/416	
TP102027/JUV		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/FI2003/000231	26.03.2003	27.03.2002
International Patent Classification (IPC) or national classification and IPC		
G01N 21/86		
Applicant		
METSO AUTOMATION OY et al		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 4 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   a. ☒ *(sent to the applicant and to the International Bureau)* a total of 3 sheets, as follows:
      ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
      ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
   b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s)) _____, containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).
4. This report contains indications relating to the following items:
   - ☒ Box No. I Basis of the report
   - ☐ Box No. II Priority
   - ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - ☐ Box No. IV Lack of unity of invention
   - ☒ Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - ☐ Box No. VI Certain documents cited
   - ☐ Box No. VII Certain defects in the international application
   - ☐ Box No. VIII Certain observations on the international application

Date of submission of the demand	Date of completion of this report
24.10.2003	21.06.2004
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Form PCT/IPEA/409 (cover sheet) (January 2004)

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/FI2003/000231

Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

   ☒ This report is based on a translation from the original language into the following language english, which is the language of a translation furnished for the purposes of:

   ☐ international search (under Rules 12.3 and 23.1(b))
   ☒ publication of the international application (under Rule 12.4)
   ☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the **elements** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report):*

   ☐ the international application as originally filed/furnished

   ☒ the description:
   pages 1-13 as originally filed/furnished
   pages* _____ received by this Authority on _____
   pages* _____ received by this Authority on _____

   ☒ the claims:
   pages _____ as originally filed/furnished
   pages* _____ as amended (together with any statement) under Article 19
   pages* 15-17 received by this Authority on 16.04.2004
   pages* _____ received by this Authority on _____

   ☒ the drawings:
   pages 1-3 as originally filed/furnished
   pages* _____ received by this Authority on _____
   pages* _____ received by this Authority on _____

   ☐ a sequence listing and/or any related table(s) – see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:

   ☐ the description, pages _____
   ☐ the claims, Nos. _____
   ☐ the drawings, sheets/figs _____
   ☐ the sequence listing *(specify)*: _____
   ☐ any table(s) related to the sequence listing *(specify)*: _____

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

   ☐ the description, pages _____
   ☐ the claims, Nos. _____
   ☐ the drawings, sheets/figs _____
   ☐ the sequence listing *(specify)*: _____
   ☐ any table(s) related to the sequence listing *(specify)*: _____

* *If item 4 applies, some or all of those sheets may be marked "superseded."*

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/FI2003/000231

Box No. V **Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Claims	1-8	YES
	Claims		NO
Inventive step (IS)	Claims	1-8	YES
	Claims		NO
Industrial applicability (IA)	Claims	1-8	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)

Documents cited in the International Search Report:

A) US 6118132 A (B.Tullis), 12 Sept 2000
B) EP 1033881 A2 (Hildeco OY LTD), 6 Sept 2000
C) US 5960374 A (P.P.Lausier), 28 Sept 1999
D) US 5990468 A (G.Cornuelols), 23 November 1999
E) US 6229972 A (A.J.Rushing), 8 May 2001

In a view of new claims, amended at 16-04-2004, documents A and B are reconsidered to represent the state of the art, together with remaining documents C-E.

Document A discloses a system for control of condition of a moving web comprising two photosensor arrays positioned above the web and separated by a fixed distance. In operation, a visible pattern located at a first location of the web is evaluated by the first photosensor array at a first time and a same pattern is evaluated at a later time by the second photosensor array. Knowing the velocity of the web, the time difference between evaluations, as well as the distance between the first and second photosensor arrays, a processing unit can determine actual location of the deviation of the web (see column 5,line 10-column 6,line 54; column 11,line 7-53). The processing unit can either measure or calculate the velocity of the web. In this regard a pattern unique to the web may be detected by the first photosensor array at a first time and at the different location shortly thereafter. Knowing the time differential and displacement between first and second locations, the processing unit may calculate the current velocity of the web and use it for the method

.../...

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
Continuation of: Box V

explained above (see column 7,line 5-column 8,line 16).

Document B discloses a method for synchronising image data obtained from process monitoring cameras whereby one and he same area in a paper web can be sought as it passed the different camera positions. A continuous video image is produced by a video camera and each camera is provided with its own digital image processor for storing and processing the image data. A selection area corresponding to the limited number of sequential images in the environment of the point of synchronisation of each camera position is visualised for the operator (see column 2, line 5-column 4, line 15).

However, none of the cited documents discloses a method for quality or condition monitoring of manufacturing and/or finishing of a fibre web process involving automatic synchronizing of image information in time-related manner, where the image information is acquired from several measuring positions from several different process stages, and with several camera units.
In view of the cited documents such a method cannot be considered obvious to a person skilled in the art.

Therefore the invention claimed in claims 1 - 8 is novel and considered to involve an inventive step.

The claimed invention is regarded to be industrially applicable.

Claims:

1. A method for synchronizing information of different stages of a process produced by optical imaging measuring devices (1–N) which monitor the manufacturing and/or finishing process of a fibre web, in relation to the movement of the fibre web in the machine direction for monitoring the quality and/or condition of said process, which method comprises the steps of

— monitoring the moving fibre web and/or a moving means involved in the processing of the fibre web by means of imaging measuring devices (1–N) placed in successive measuring positions in the machine direction,

— recording the information acquired from said imaging measuring devices (1-N) in different measuring positions,

— searching the information recorded by imaging in the different measuring positions, for images, or the like, relating to the same local area of the fibre web, and

— analyzing said images, or the like, relating to the same local area of the fibre web in different measuring positions, for monitoring the quality and /or condition of said process,

characterized in that the method also comprises the steps of

— searching the images, or the like, recorded in the different measuring positions, by digital pattern recognition, for a feature / features (30) relating to the same local area of the fibre web, and

— determining travel time delays of the fibre web between the different measuring positions on the basis of time data included in said feature/features (30) upon the recording of images, or the like, in the different measuring positions for automatically synchronizing, with each other in time, said images or the like, recorded in different measuring positions with the movement of the fibre web in the machine direction.

2. The method according to claim 1, **characterized** in that in information recorded by imaging in each measuring position (1–N), the search is limited to a given sequence (W) comprising successive images or the like, which sequence is defined by means of approximate synchro-

nization based on the distance (22) between the measuring positions and the speed data (21) of the fibre web.

3. The method according to claim 1 or 2, **characterized** in that in the information recorded by imaging in each measuring position (1–N), the search is limited to a given area (ROI) narrower than the production width of the fibre web in the transverse direction.

4. The method according to any of the preceding claims, **characterized** in that the information recorded by imaging is processed by methods of digital image processing to emphasize the feature/features (30) to be searched in the fibre web and/or a moving means involved in the processing of the fibre web, to facilitate pattern recognition.

5. The method according to any of the preceding claims, **characterized** in that the information recorded by imaging is produced with cameras, preferably cameras of the visible wavelength range or thermal cameras operating in the infrared range.

6. The method according to any of the preceding claims 1 to 4, **characterized** in that the information recorded by imaging is produced with imaging measuring devices based on spectral resolution, for example imaging spectrometers.

7. The method according to any of the preceding claims, **characterized** in that the information recorded by imaging is produced substantially over the whole production width of the fibre web or on only a part of the production width of the fibre web.

8. The method according to any of the preceding claims, **characterized** in that the feature (30) to be found in the information recorded by imaging is a local edge defect, a hole, a tear, a coating defect in the fibre web and/or a moving means involved in the processing of the fibre web, such as a wire, a felt, a roll, a reel, or the like; a tail of the fibre web passing through the manufacturing and/or finishing apparatus in connection with an event of break in the fibre web; or a locally discerni-

ble phenomenon caused by the user by marking in the fibre web or in a moving means involved in its processing.

Claims:

1. A method for synchronizing information produced by optical imaging measuring devices (1–N) which monitor the manufacturing and/or finishing process of a fibre web, in relation to the movement of the fibre web in the machine direction, which method comprises the steps of

— monitoring the moving fibre web and/or a moving means involved in the processing of the fibre web by means of imaging measuring devices (1–N) placed in successive measuring positions in the machine direction, and

— searching the information recorded by imaging in the different measuring positions, for images, or the like, relating to the same local area of the fibre web, for their analysis and/or storage,

characterized in that the method also comprises the steps of

— searching the images, or the like, recorded in the different measuring positions, by digital pattern recognition, for a feature / features (30) relating to the same local area of the fibre web, and

— determining travel time delays of the fibre web between the different measuring positions on the basis of time data included in said feature/features (30) upon the recording of images, or the like, in the different measuring positions.

2. The method according to claim 1, **characterized** in that in information recorded by imaging in each measuring position (1–N), the search is limited to a given sequence (W) comprising successive images or the like, which sequence is defined by means of approximate synchronization based on the distance (22) between the measuring positions and the speed data (21) of the fibre web.

3. The method according to claim 1 or 2, **characterized** in that in the information recorded by imaging in each measuring position (1–N), the search is limited to a given area (ROI) narrower than the production width of the fibre web in the transverse direction.

4. The method according to any of the preceding claims, **characterized** in that the information recorded by imaging is processed by methods of digital image processing to emphasize the feature/features (30) to be searched in the fibre web and/or a moving means involved in the processing of the fibre web, to facilitate pattern recognition.

5. The method according to any of the preceding claims, **characterized** in that the information recorded by imaging is produced with cameras, preferably cameras of the visible wavelength range or thermal cameras operating in the infrared range.

6. The method according to any of the preceding claims 1 to 4, **characterized** in that the information recorded by imaging is produced with imaging measuring devices based on spectral resolution, for example imaging spectrometers.

7. The method according to any of the preceding claims, **characterized** in that the information recorded by imaging is produced substantially over the whole production width of the fibre web or on only a part of the production width of the fibre web.

8. The method according to any of the preceding claims, **characterized** in that the feature (30) to be found in the information recorded by imaging is a local edge defect, a hole, a tear, a coating defect in the fibre web and/or a moving means involved in the processing of the fibre web, such as a wire, a felt, a roll, a reel, or the like; a tail of the fibre web passing through the manufacturing and/or finishing apparatus in connection with an event of break in the fibre web; or a locally discernible phenomenon caused by the user by marking in the fibre web or in a moving means involved in its processing.